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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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09/718,850

11/22/2000

Ramachandra Divakaruni

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12/30/2003

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EXAMINER

GEBREMARIAM, SAMUEL A

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 12/30/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/718,850

Applicant(s)

DIVAKARUNI ET AL.

Examiner

Samuel A Gebremariam

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 August 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5, 7-17 and 23-25 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5, 7-17 and 23-25 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 22 April 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
- a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. Claims 1 and 23 are objected to because of the following informalities: In lines 6-8 applicant claims the limitation "single-thickness oxide". Judging from the figure, applicant is trying to say "uniform thickness". Appropriate correction is required.

Specification

2. The disclosure is objected to because of the following informalities: on page 2 and line 3 of the specification the word "has" appears to have a typographical error. Appropriate correction is required.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 2, 5, 7-17 and 23-24, are rejected under 35 U.S.C. 103(a) as being unpatentable over Eklund US patent No. 5,087,580 in view of Peidous US patent No. 6,001,700 and in further view of Blair US patent No. 5,904,536.

Regarding claim 1, Eklund teaches a method (figs. 2-8) of forming an emitter in a vertical bipolar transistor comprising: providing a substrate (16) having a collector layer (26 and a base layer 48 over the collector layer; forming a patterned mask over the base layer and filling the opening in the mask with emitter material where the emitter material contacting the substrate.

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Eklund fails to disclose i) a collector layer and the base layer formed by implantation through a single mask formed on the substrate, ii) filling the opening in the mask with emitter material using damascene process and iii) filling more than one opening.

Peidous teaches forming base and collector of a bipolar transistor by implantation using a single masking step on a substrate, where the single mask have a uniform thickness across individual elements of the bipolar transistor (col. 1, line 63-, col. 2, line 25).

Blair teaches (col. 2, lines 57-67) the use of damascene process for forming a self-aligned polysilicon emitter in the process of forming a bipolar transistor.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the single masking step of forming the base and collector of the bipolar transistor in the process of Eklund in order to reduce the number of photoresist ion implant masking steps (col. 2, lines 1-4). Furthermore it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the damascene process taught by Blair in to the combined process of Eklund and Peidous in order to form the emitter of the bipolar transistor since damascene process eliminates the need for over etching of epitaxial silicon in the base region because the process is selective to polysilicon over epitaxial silicon.

It would also have been obvious to one of ordinary skill in the art at the time the invention was made to make more than one opening and filling the openings in the

mask with emitter material since the formation integrated circuit involves the fabrication of more than one bipolar transistor.

Regarding claim 2, Eklund teaches substantially the entire process steps of claim 1 above including the substrate includes an insulator layer (10) between the bottom silicon layer and a top silicon layer (16), the method further comprising implanting a first impurity to form the collector layer (26) in a lower portion of the top silicon layer adjacent the insulator layer and implanting a second impurity to form the base layer (48) in an upper portion of the top silicon layer (figs. 2-8).

Regarding claim 5, Eklund teaches substantially the entire process step of claim 1 above including forming a protective layer (74) over the emitter and implanting additional amounts of the first impurity into and through the insulator layer to provide a collector contact diffusion region 76 (fig. 8).

Regarding claims 7-17, Eklund teaches substantially the entire process steps of claims 1-5 above including the method of simultaneously forming CMOS devices and vertical bipolar transistor on an integrated circuit chip comprising: providing a silicon on silicon over insulator substrate having a collector layer (26) and a base layer (48) over the collector layer; forming a gate oxide layer (44) only the CMOS region of the SOI substrate, forming a polysilicon layer (46) of the CMOS region of the SOI substrate, patterning a mask over the polysilicon layer and the bipolar region of the SOI substrate, the mask including openings (54) over the bipolar region; depositing an emitter material to form emitters; removing the mask; patterning the polysilicon layer to form gate

conductor (62) and forming sidewall spacers (74) adjacent the emitter and the gate conductors (figs. 2-8).

Regarding claim 23, Eklund teaches (figs. 2-8) substantially the entire claimed process of claims 1-17 above including a bipolar device on a SOI substrate having a semiconductor layer (16) overlying buried layer insulator (10) to form an interface where a surface of the semiconductor layer is adjacent to a surface of the buried insulator, comprising the steps of forming in the semiconductor layer a buried collector region (26) centered at approximately the interface and forming in the semiconductor layer a base region vertically stacked on the buried collector region.

Regarding claim 24, Eklund teaches (figs. 2-8) substantially the entire claimed process of claim 23 above including the buried collector region and the base region are formed by implantation through a single mask formed on the SOI substrate.

Claims 3 and 25, are rejected under 35 U.S.C. 103(a) as being unpatentable over Eklund, Blair, Peidous and in view of Miwa et al. US patent No. 5,352,624.

Regarding claim 3, Eklund teaches substantially the entire process step of claim 1 above including first impurity emitter diffusion region (61) in the base below the emitter 60.

Eklund fails to teach the method of claim 2 further comprising annealing the vertical bipolar transistor to drive the first impurity into the base to create an emitter diffusion region in the base below each emitter.

Annealing the vertical transistor to drive impurities into the base to create an emitter diffusion region is a conventional process and is also taught by Miwa in the

process of manufacturing a bipolar transistor structure (fig. 20I, col. 39, line 63-, col. 40, line 2).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the conventional annealing process the process of Eklund in order to speed the diffusion process.

Regarding claim 25, Eklund teaches substantially the entire process steps of claims 23, 1 and 3 above including forming a mask having opening (54) on the SOI substrate and depositing an emitter material contacting the SOI substrate (26) having a first impurity in the opening to form an emitter (60).

Claim 4, is rejected under 35 U.S.C. 103(a) as being unpatentable over Eklund, Peidous, Blair and in view of Horie US patent No. 5,406,113.

Regarding claim 4, Eklund teaches substantially the entire process steps of claim 1 above except explicitly stating that the method of claim 2 further comprising: patterning a second mask over the bipolar region the mask including openings through to the base layer between one of the emitter and implanting additional amounts of the second impurity into the base layer through the openings.

It is conventional to form openings by patterning a masking layer and also taught by Horie (Horie, figs 3a-3g) with reference to bipolar structure since such structures are readily used for forming impurity regions that are subsequently used for metallization purposes.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to implant impurity in the structures taught by Horie in the process

of Eklund in order to reduce contact resistance between base region and base electrode.

Response to Arguments

4. Applicant's arguments with respect to claims 1-5, 7-17 and 23-25 have been fully considered but are not persuasive. In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971). Applicant argues that Peidous teaches a non-uniform thickness oxide layer as mask while the invention claims a uniform thickness (single thickness) oxide layer. Since applicant does not explicitly state that the oxide layer has a uniform thickness across the whole substrate, the combined process of Eklund, Peidous and Blair still reads on the claimed invention.

Conclusion

5. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not

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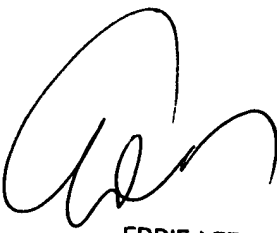
mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Samuel Admassu Gebremariam whose telephone number is 703 305 1913. The examiner can normally be reached on 8:00am-4: 30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on (703) 305-1690. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 872-9306 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Samuel Admassu Gebremariam
November 21, 2003



EDDIE LEE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800